

Claus Peter Buszello
on behalf of the Uppsala HEP group



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Collider based particle physics at Uppsala University

Partikeldagarna, October 16-17th 2008

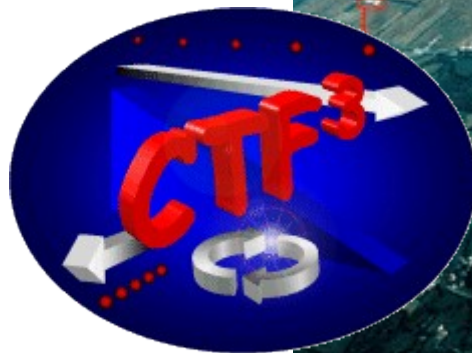
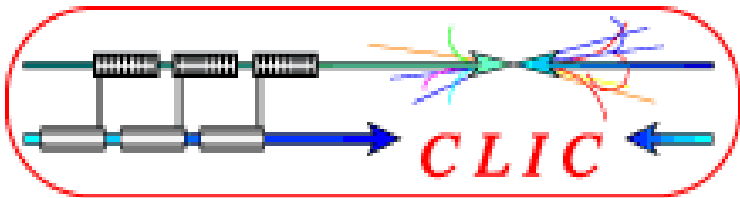
C. Bélanger- Champagne, N. Bingefors, R. Brenner, C. Buszello, E. Coniavitis, T. Ekelöf, M. Ellert, A. Ferrari, M. Flechl, C. Isaksson
J. Jönemo, L.E. Lindquist, B. Mohn, Roger Ruber, Volker Ziemann



SweGrid



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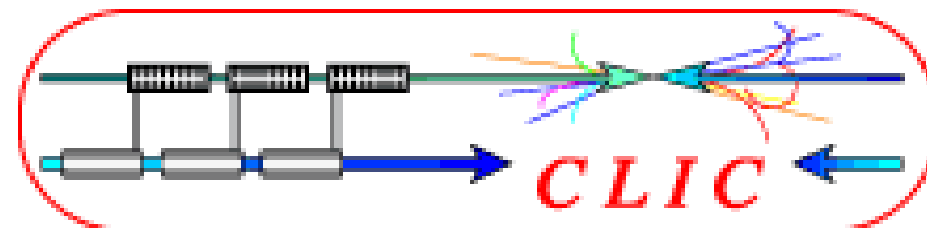
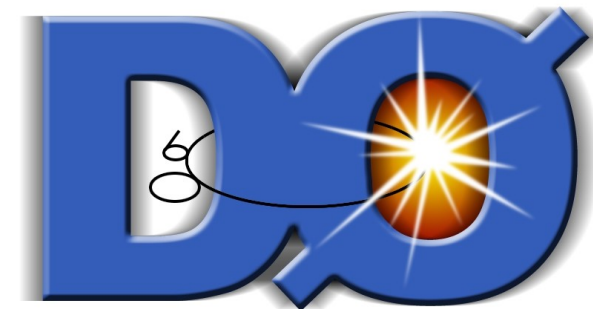


NOT in this presentation



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- The Matrix Element Method at $DØ$ as a direct search method for a charged Higgs boson
 - Camille Belanger-Champagne
- CLIC Presentation
 - Volker Ziemann
- EuroTeV Presentation
 - Arnaud Ferrari





Physics focus: Charged Higgs

- Chances for an unaltered SM Higgs sector getting quite slim.
 - CP violation
 - Dark matter
- Two Higgs doublets (e.g SUSY) => Charged Higgs



Prospect
D
Uppsala

International Scientific
Kétyvi Assamagan
Gregorio Bernardi
Dhiman Chakrabarti
Sven Heinemeyer
Karl Jakobs
Tom Junk
Sabine Kraml
Stefano Moretti
Steve Mrenna
Alexandre Nikitin
Per Osland
Tilman Plehn
Albert de Roeck
André Sopczak
Michael Spira

URL: www.fysast.uu.se/chargedhiggs2008

Prospects for Charged Higgs
Discovery at Colliders
Uppsala University, Sweden, 16-19 September 2008

International Scientific Advisory Committee:
Kétyvi Assamagan (BNL, USA)
Gregorio Bernardi (University of Paris, France)
Oliver Brein (University of Freiburg, Germany)
Dhiman Chakrabarti (FNAL, USA)
Sven Heinemeyer (University of Zaragoza, Spain)
Karl Jakobs (University of Freiburg, Germany)
Tom Junk (University of Illinois, USA)
Riitta Klunne (Finnish Institute of Physics, Finland)
Sabine Kraml (CERN, Switzerland)
Pierre Lutz (CEA Saclay, France)
Stefano Moretti (University of Southampton, UK)
Alexandre Nikitin (C. University of London, UK)
Per Osland (University of Bergen, Norway)
Tilman Plehn (University of Edinburgh, UK)
Albert de Roeck (CERN, Switzerland)
Peter Skands (FNAL, USA)
André Sopczak (Sussex University, UK)
Michael Spira (PS, Switzerland)

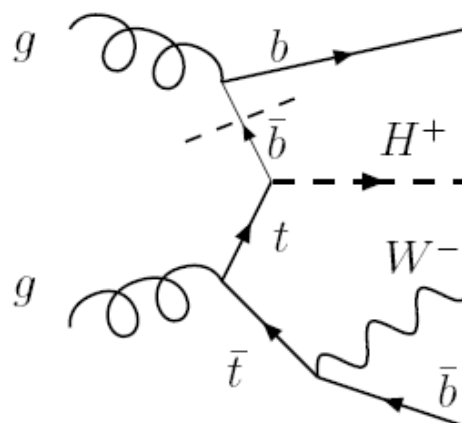
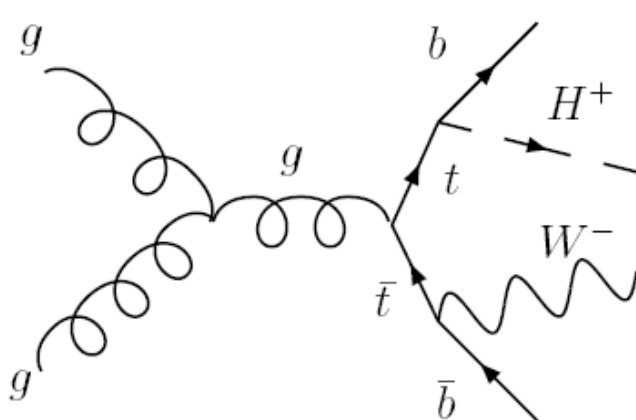


Topics:
• Search strategies, systematics and analysis tools
• Phenomenology and Monte Carlo
• Theory
We welcome contributed talks

Local Organisation Committee:
Camille Bédaride-Champagne
Richard Brenner, Claus Buszello,
Elias Conradi, Tord Ekelof,
Christy Mertes Eilers, Inger Eriksson
Secretary: David Eriksson, Arnaud Ferrari,
Martin Fiechl, Nazila Mahmoudi, Bjarte Melin, Johan Rathsman
Co-Chair: Oscar Stål

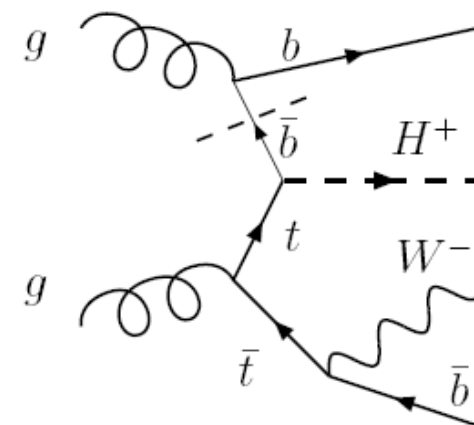
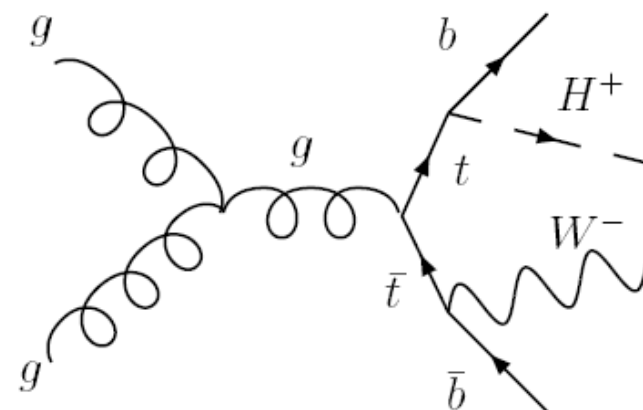


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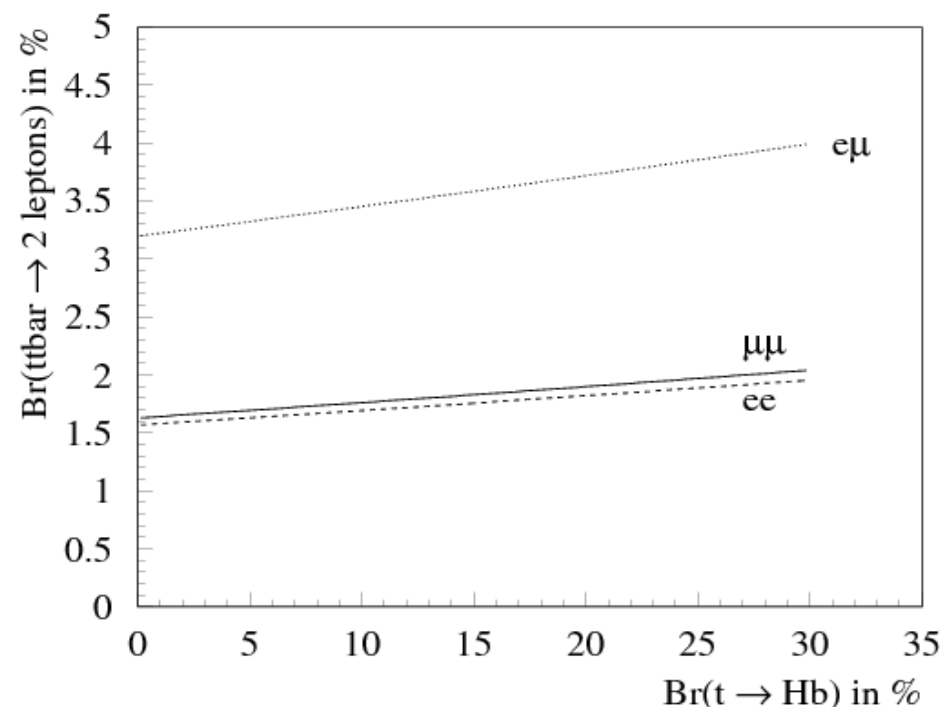
Physics Overview

- Staggered plan:
 - Indirect searches at DØ, then ATLAS
 - Direct search in suitable modes when they become statistically feasible
 - $m_H < m_t$: top pair decays
 - $m_H > m_t$: bottom top fusion
 - H^+ decay to τ (hadronic τ decay)
- Obvious consequences:
 - Trigger on $\tau \Rightarrow \tau$ trigger studies
 - Need to understand top pair production ... as signal *and* background
 - Prepare for the SLHC (... CLIC)



Indirect H^+ searches

- Very similar pattern:
 - $tt \rightarrow W^+bW^-b \rightarrow ll bb w$
 - $tt \rightarrow H^+bW^-b \rightarrow \tau l bb w$
- $H^+ \rightarrow \tau \rightarrow l$ decays more frequent than $W^+ \rightarrow l$



- Using hadronic τ decays:
 - Get relative $tt \rightarrow \tau l X / tt \rightarrow ll X$ cross sections
 - ... figure in leptonic τ decays
 - ... look for an excess of τ or set a limit

D0: Statistics \leftrightarrow ATLAS: Systematics



The H⁺ CSC effort

- Start June 2006; now at the end of the publication process
- For the first time: Simulation studies of all of the most promising H⁺ channels with
 - a realistic detector simulation
 - full consideration of all trigger levels
 - inclusion of dominating systematic uncertainties
 - in a common framework
- Aim: To get the machinery ready for first data
- More than 20 people from about a dozen of institutions directly involved

Direct H^+ searches – CSC results



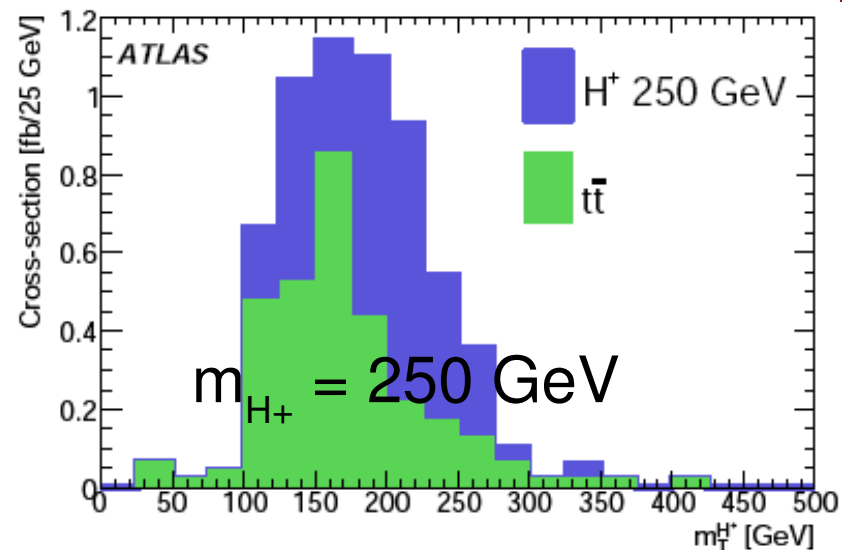
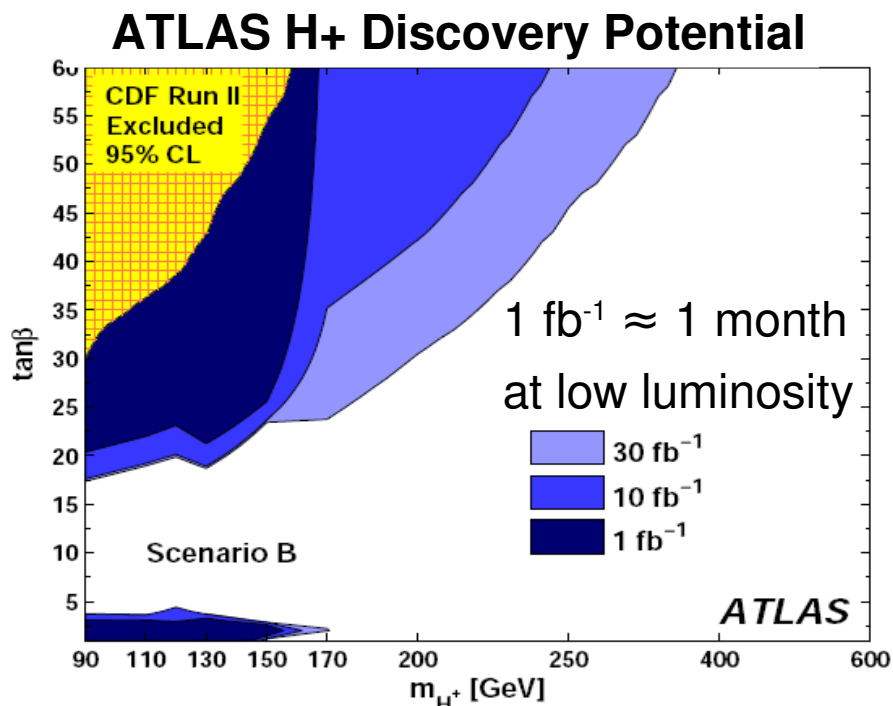
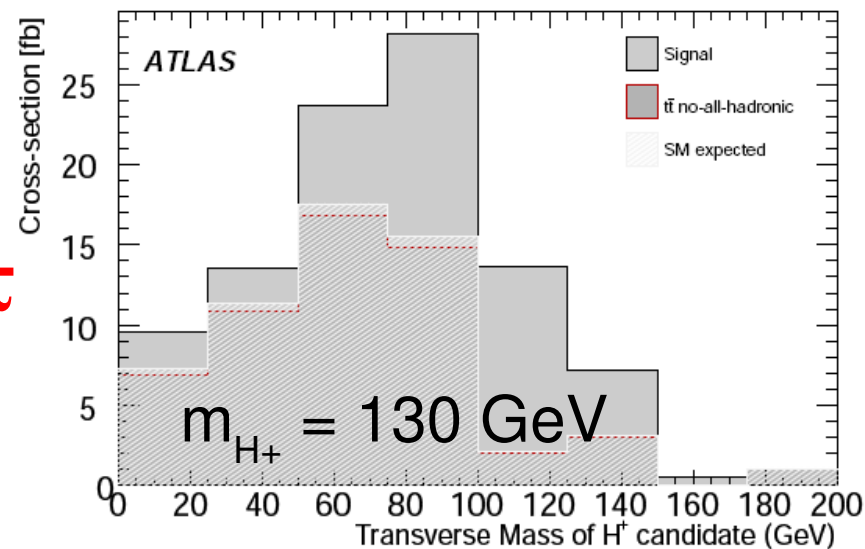
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- Channels studied in Uppsala:

“Light”: $tt \rightarrow bWbH^+ \rightarrow bqqb\nu\tau$

“Heavy”: $gg/gb \rightarrow t[b]H^+ \rightarrow [b]bqq\nu\tau$

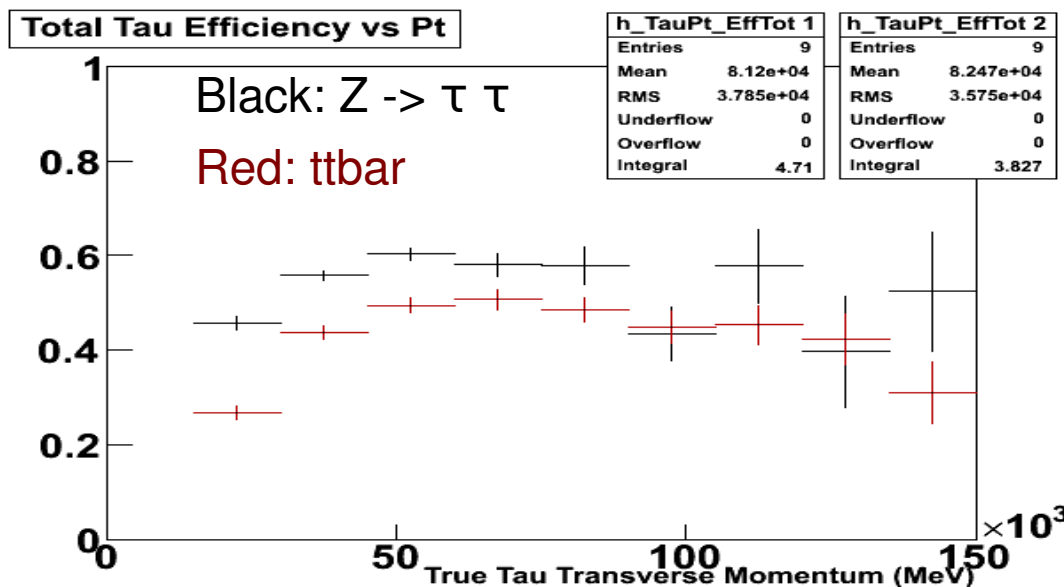
- Next, isolate critical issues ...



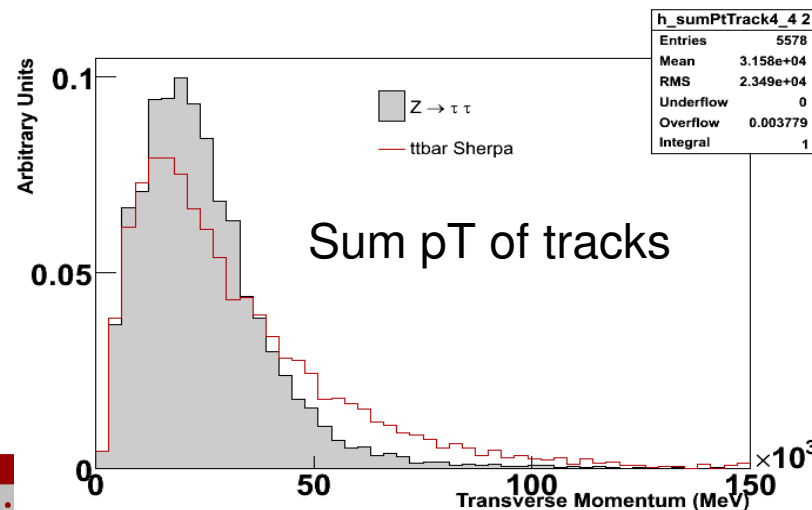
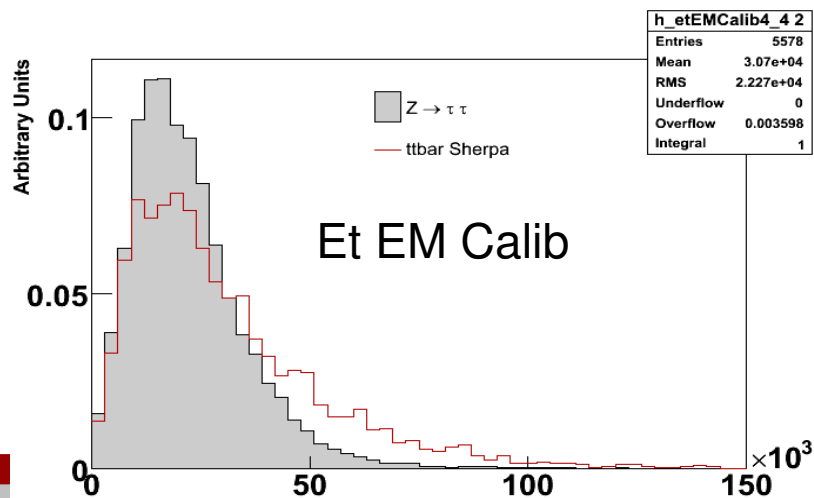
Tau identification in busy events



Is tau ID influenced by the busier environment in ttbar events?



=> Study critical variables and possibly optimise likelihood for busy events:

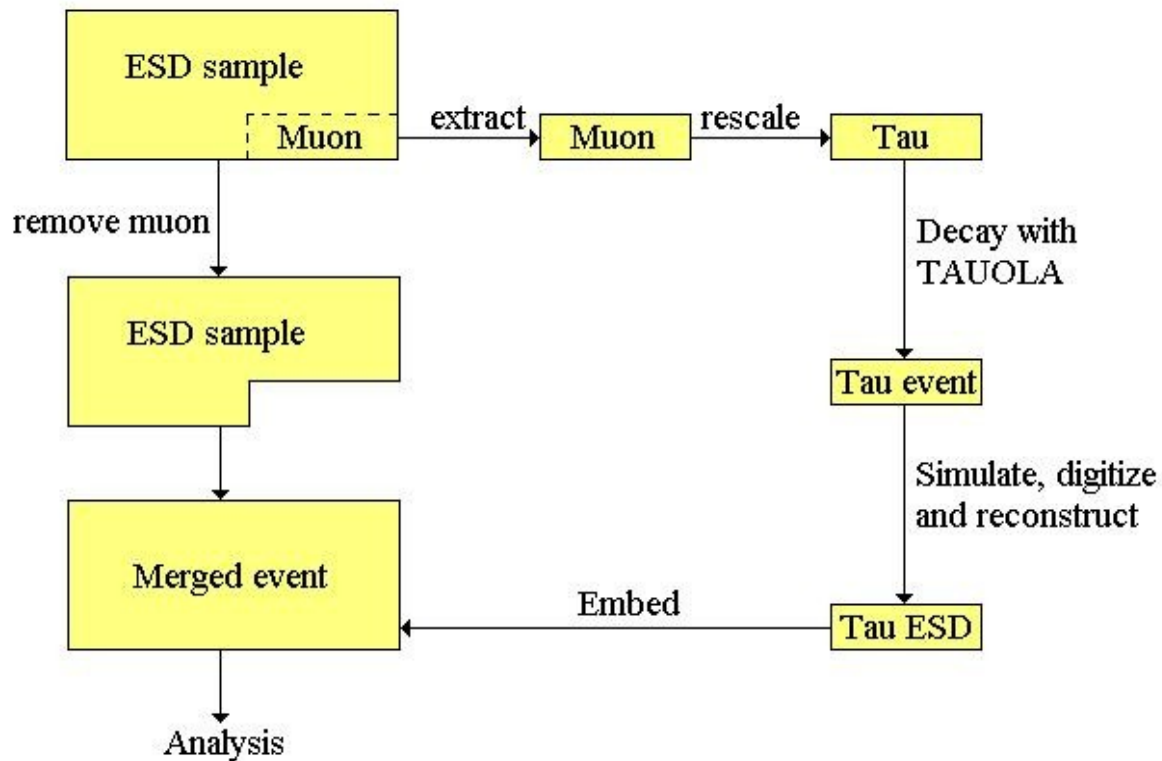


Top pair background modeling



Want to extract bkg info from data (Reduce systematics)

Idea: Replace μ in real $t\bar{t}$ -bar data sample with simulated τ



- Replace calorimeter cells around muons in the original $t\bar{t}$ -bar $\rightarrow \mu\mu + X$ event with cells from the τ -decay event.
- Original muon tracks are replaced with tracks from the τ -decay event.
- The data is then run through reconstruction again to produce the final $t\bar{t}$ -bar $\rightarrow \tau\tau \rightarrow \mu\mu$ control sample

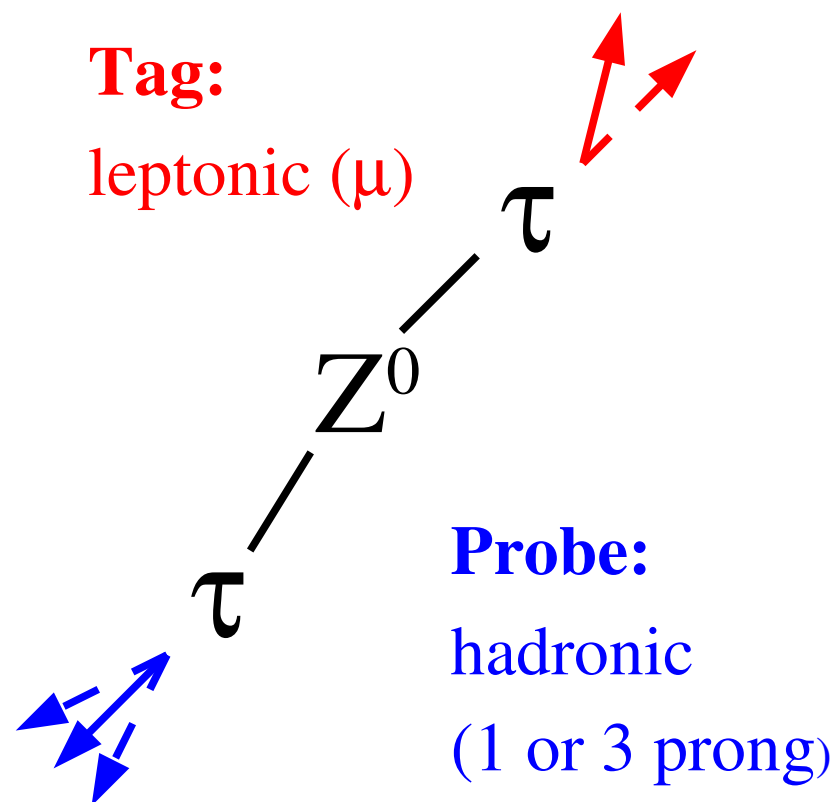
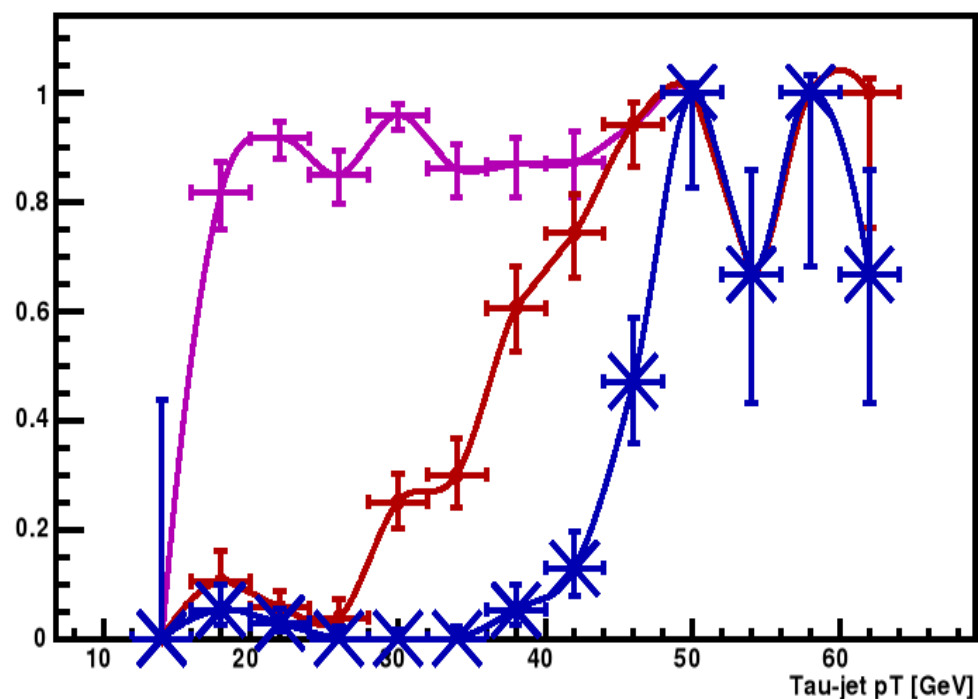
✓ Machinery is set up. Next steps:

- Make sure the methods works as expected and try to understand/tune the details
- Optimize selection of $t\bar{t}$ -bar(μ)-events for high purity

Tau trigger efficiencies

- Expect ~ 400 Z events for each data slice of 100pb^{-1}
- Can be used rapidly to measure efficiency from data using tag and probe:

Trigger efficiency L2: TAU25i, TAU45, TAU60



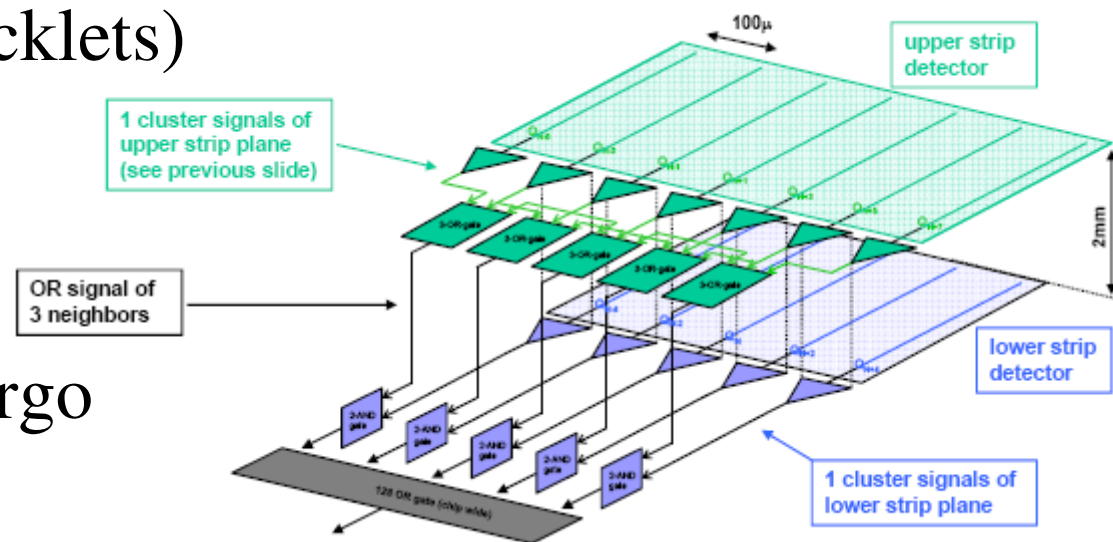
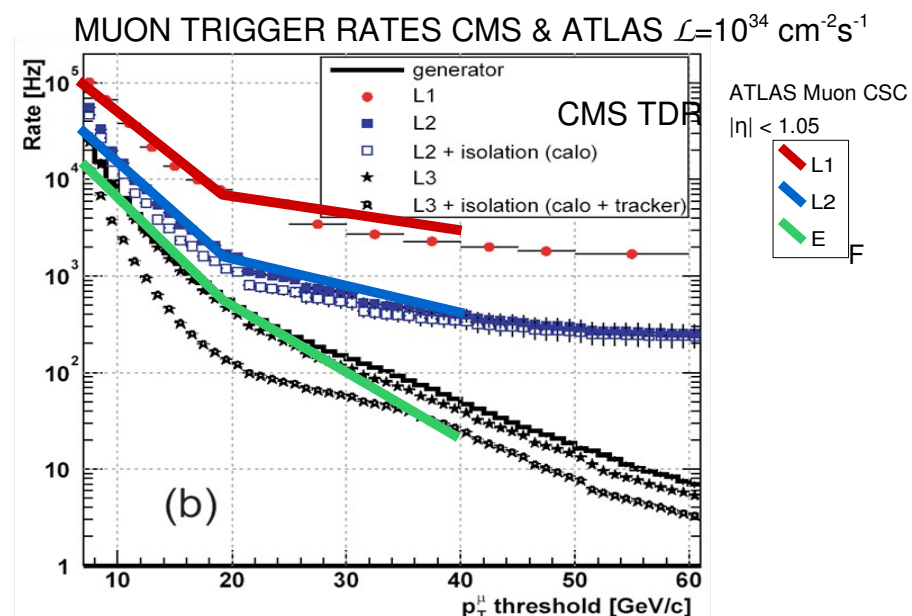


Tau trigger MC matching

- Early trigger work relies on MC simulation: distributions of MC events must be made to match data (when it arrives) as rapidly as possible in the variables used by the τ trigger
- Using a mixture of MC events from all samples expected to contain many τ 's and jets
- Currently studying variable correlations in MC, weighting of events on a histogram-by-histogram basis and on an event-by-event basis

Track trigger for SLHC

- Goals:
 - Improve L1 muon trigger by adding tracking information
 - Secondary vertex trigger
 - Particle multiplicity trigger
- Development
 - Detector module design that select high pT tracks (tracklets)
 - Logic for track trigger
- Tools
 - H8 testbeam with Morpurgo magnet



Grid activities I

- We participate in numerous grid development projects, including

- NorduGrid
- SweGrid
- Nordic Data Grid Facility (NDGF)
- KnowARC
- NGin



Grid activities II



- Development and maintenance of NorduGrid ARC client tools
 - ngsb, ngstat, ... (current stable release)
 - arcsb, arcstat, ... (new development release)
- Storage Gateways
 - access to 3rd party storage systems through ARC
- Availability monitoring tests of ARC enabled computing resources
- ATLAS tier2/tier3 cluster (grad.uppmax.uu.se)

Summary



- “Finalizing” DØ: ME-Method, indirect H+ searches
- “Starting” ATLAS: Direct and indirect H+ searches
- “Never-ending”: Services / techniques / tools:
 - trigger studies, tau-id optimisation, background modeling
 - Very active Grid maintenance and development
- And into the future:
 - CLIC development at CTF3
 - Track trigger studies for SLHC